prototype of a class of speculative treatment, considerable in number, some of them recent, and all of them futile."

IN the current number of the *Zeitschrift für anorganische Chemie*, Prof. B. Brauner describes the preparation and properties of acid sulphates of the rare earths. The cerium salt has the formula $Ce_2(SO_4)_3.3H_2SO_4$, and salts of the same type have also been obtained for lanthanum, praseodymium, neodymium, samarium and yttrium. These acid sulphates are only incompletely converted into the normal salts at high temperatures, and the author's opinion is that all atomic weight determinations of the rare earth metals, in which the sulphates obtained synthetically have been employed, are on this account inaccurate.

IN the March number of the *Physical Review*, Mr. T. E. Doubt describes some experiments dealing with the effect of the intensity on the velocity of light. The results of these experiments justify the conclusion that for light travelling in air a change in intensity in the ratio of 1 to 290,000 does not alter its velocity by as much as 57 centimetres per second. In the case of water, a change in intensity in the ratio of 1 to 43,000 does not alter the velocity by as much as 80 centimetres per second, that is, by 1 part in 1000 million parts.

THE additions to the Zoological Society's Gardens during the past week include a Pig-tailed Monkey (*Macacus nemestrinus*) from India, presented by Mrs. Mackenzie Fraser; a Smooth-headed Capuchin (*Cebus monachus*) from South-east Brazil, presented by Mr. Arthur Collins; a Ruffed Lemur (*Lemur varius*) from Madagascar, presented by Lady Constance Stewart Richardson; a Pigmy Hog (*Porcula salviana*) from Bhotan, presented by Mr. D. H. Felce; two Markhoors (*Capra megaceros*) from North-east India, two Punjaub Wild Sheep (*Ovis cycloceros*) from North-west India, presented by Colonel Deane; three Chinchillas (*Chinchilla lanigera*) from Chili, presented by Mr. Andres Ker; two Coypu Rats (*Myopotamus coypus*) from South America, presented by Mr. H. L. Horsfall; two Ring-tailed Pigeons (*Columba caribbaea*) from Jamaica, presented by Mr. D. Seth-Smith; two Spur-winged Geese (*Plectropterus gambensis*) from West Africa, presented by Mr. J. Lemberg; two Nutmeg Fruit Pigeons (*Myristicivora bicolor*) from Moluccas, two Imperial Nicobar Fruit Pigeons (*Carpophaga insularis*) from the Nicobar Islands, four Andaman Teal (*Nettion albigulare*), three Andaman Banded Crakes (*Rallina canningi*), six Great-billed Andaman Parrakeets (*Palaeornis magnirostris*) from the Andaman Islands, presented by the Government of India; an Exanthematic Monitor (*Varanus exanthematicus*) from West Africa, presented by Mr. Dayrell; a Rufescent Snake (*Leptodira hotambioea*) from South Africa, presented by Mr. B. McMillan; an Allen's Bassaricyon (*Bassaricyon alleni*), six Red and Black Snakes (*Erythrolampus venustissimus*) from South America, an Australian Cassowary (*Casuarius australis*), a Gould's Monitor (*Varanus gouldi*), a Lace Monitor (*Varanus varius*), a Blue-tongued Lizard (*Tiliqua scincoides*), a Derbian Wallaby (*Macropus derbianus*) from Australia, a Sooty Phalanger (*Trichosurus fuliginosus*) from Tasmania, two Australian Barn Owls (*Strix delicatula*) from Australia, an Orton's Guan (*Penelope ortoni*) from Ecuador, a Gold-crested Mynah (*Ampeliceps coronatus*) from India, a Sarus Crane (*Grus antigone*) from Northern India, five Lineated Sand Skinks (*Chalcides lineatus*), South European; four Californian Newts (*Molge torosa*) from California, deposited; a Black Ape (*Cynopithecus niger*) from the Celebes, ten Crested Pigeons (*Ocyphaps lophotes*) from Australia, purchased.

OUR ASTRONOMICAL COLUMN.

SOLAR WORK AT THE SMITHSONIAN ASTROPHYSICAL OBSERVATORY.—Incorporated in the annual report of the Smithsonian Institution, for the twelve months ending June 30, 1903, is a report of the work performed in the Astrophysical Observatory, during that period, by Mr. C. G. Abbot who is in charge.

A new horizontal telescope of 20 inches aperture and 140 feet focal length, fed by a novel form of two-mirror cœlostat, and fitted with an apparatus for thoroughly churning the air inside the tube during the observations, has been mounted for the bolographic study of the solar image, and especially sun-spot energy spectra and the absorption of the solar envelope.

The most notable result of the study of the atmospheric absorption during the above named period was the decreased transparency of the atmosphere, at Washington, for all wave-lengths, but especially for the violet and ultra-violet radiations. Other results showed that this result was not caused by an excess of moisture in the atmosphere. Several plates which are included in the report show a diagrammatic view of the new instrument, typical "bolographic energy" and "atmospheric transparency" curves, a curve showing the distribution of radiation in the normal solar spectrum outside the earth's atmosphere, and a photograph of the large cœlostat with the second mirror.

METEOR RADIANTS OBSERVED AT ATHENS.—A communication from Prof. D. Eginitis to No. 3941 of the *Astronomische Nachrichten* gives a list of the radiants observed at Athens during 1902. Two radiants not given in Denning's "General Catalogue" were recorded in June and July, respectively, as follows:—

June 27, 10h. 58m. − 12h. 16m. (Athens M.T.) $\alpha = 230°$, $\delta = +73°$
July 29, 10h. 40m. − 11h. 27m. („) $\alpha = 85°$, $\delta = +85°$

Several of the radiants obtained from the observations at Athens differ considerably both in time and position from their respective values given in the above named catalogue.

The observed radiant for the Perseid shower spreads over a large area, and the principal centre, situated near to η Persei, alters its position considerably. The Perseids from the region near to α Persei were generally red and bright, whilst those from near η Persei were fainter and of a reddish-yellow colour.

SOLAR FACULÆ AND PROMINENCE VARIATIONS.—In a paper communicated to No. 3, vol. xxxiii., of the *Memorie della Società degli Spettroscopisti Italiani*, Prof. Mascari analyses the latitude and frequency variations of faculæ, as observed at Catania, in a manner similar to that recently used by Sir Norman and Dr. Lockyer, whose results he corroborates, for the spots and prominences.

After discussing the data obtained from his observations in a series of tables and curves, he arrives at the following general conclusions:—(1) The zone of maximum activity of the groups of faculæ lies between the mean latitude $\pm 45°$ and the equator, and pursues a movement parallel to, and coincident with, that of the spots, but the inverse of that of the prominences. (2) The faculæ beyond the principal maximum, in the equatorial region of each hemisphere, are not represented in the polar regions. (3) The centre of maximum activity of the prominences occurs generally in the region of minor activity of the faculæ.

MAGNITUDE OBSERVATIONS OF NOVA PERSEI.—In No. 3941 of the *Astronomische Nachrichten*, Father Hagen, S.J., gives a list of the magnitudes of Nova Persei as observed at Georgetown (U.S.A.) with a 12-inch refractor, from June 19, 1901, to April 18, 1903. The magnitude on the latter date, from an observation made when the Nova was near the horizon, was 11·05.

A similar list of magnitude observations, made at Kalocsa by Father M. Esch, S.J., during the period July 8, 1901 to March 22, 1902, is given in No. 3943 of the same journal

COMET 1904 *a*.—Numerous observations of this comet are recorded in Nos. 3943–4 of the *Astronomische Nachrichten*. Dr. Hartwig, observing at Bamberg on April 17, recorded the total magnitude as 9·0, and the magnitude of the nucleus alone as 10·0. The comet had a broad divided tail 4′ long, the mean position angle of which was 211°; the coma was 1′·5 in diameter.

The following is a continuation of the ephemeris published by Herr M. Ebell :—

Ephemeris oh. M.T. Berlin.

1904	α	δ
	h. m. s.	° ′
May 22 ...	14 37 10 ...	+57 57
„ 26 ...	14 20 29 ...	+58 1
„ 30 ...	14 6 26 ...	+57 44

An error, due to the ambiguity of a necessarily brief telegram, was contained in a previous paragraph concerning this object. This comet is a new one discovered by Mr. Brooks, and *not* the Brooks's comet of 1896 returned.

ORBIT OF THE SPECTROSCOPIC BINARY ι PEGASI.—No. 53 of the Lick Observatory *Bulletins* is devoted to a detailed discussion of the definitive orbit of ι Pegasi by Dr. Heber D. Curtis. The elements obtained have been derived from measurements of forty-three plates taken during the period October 7, 1897, and December 1, 1903, inclusive.

Three sets of elements, each one giving a nearer approximation to the observed values than the one preceding it, were evolved, and the derivation of each set is given in full detail. The final set gives a velocity of $-4{\cdot}12 \pm 0{\cdot}11$ km., and a period of $10{\cdot}21312 \pm 0{\cdot}00006$ days. Owing to the small eccentricity of the orbit, viz. 0·0085, the epoch of periastron is not very certain, but is given as 1899 June $14{\cdot}966 \pm 0{\cdot}352$ days.

IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held at the house of the Institution of Civil Engineers on May 5 and 6 under the presidency of Mr. Andrew Carnegie. The report of the council, read by the secretary, Mr. Bennett H. Brough, showed that the institute continues to make satisfactory progress. The president then presented the Bessemer gold medal to Mr. R. A. Hadfield (Sheffield). The announcement was made that awards of 100*l.* from the Carnegie research fund had been made to John Dixon Brunton (Musselburgh), Dr. H. C. H. Carpenter (National Physical Laboratory), E. G. L. Roberts and E. A. Wraight conjointly (London), Frank Rogers (Cambridge), and Walter Rosenhain (Birmingham), and a renewed award of 50*l.* to O. Boudouard (Paris). The Andrew Carnegie gold medal for research was awarded to Pierre Breuil (Paris), and a special medal to Percy Longmuir (Sheffield).

The first paper read was by Mr. A. Dupré and Captain M. B. Lloyd, H.M. Inspector of Explosives, on explosions produced by ferrosilicon at Liverpool on January 12 and 21. The explosion was most probably caused by water having got into the interior of the drums containing the ferrosilicon; the gas evolved formed, with the air in the drums, an easily ignited explosive mixture, which was fired by the heat produced by the friction of the hard lumps against each other when the drums were moved about, or possibly by the spontaneous ignition of some phosphuretted hydrogen contained in a pocket in the material, and liberated suddenly by the breaking of a lump on the drum being moved. Although the accidents were not attended by very grave results, it is important that all those who have to handle ferrosilicon should be alive to the possible dangers attaching to it, and by keeping it in a dry and thoroughly well ventilated place prevent the accumulation of inflammable gas as far as possible.

Prof. H. Louis (Newcastle-on-Tyne) then read a paper on the manufacture of pig iron from briquettes at Herräng, Sweden. The mining and smelting of the ore present many novel features. Briefly the scheme of operations is as follows :—The ore as mined is conveyed from the various mines by aërial wire rope-ways to the crushing works, where it is broken and crushed wet; the pulp runs to the magnetic concentrators, which take out the magnetite; the latter is conveyed by a small aërial rope-way to the briquetting house, where it is stamped into briquettes, which pass next through the briquetting furnace, in which they are burnt; they are then hoisted up to the top of a pair of charcoal furnaces, where they are smelted for high-class pig iron; the waste gases from the blast furnace fire the briquetting furnaces, and supply gas-engines which furnish the blast and also drive the dynamos of a central electrical station, from which power is conveyed to the concentrating works, as well as to the various mines for hoisting, pumping, &c. Several of the principles embodied appear destined to play an important part in the metallurgy of iron in the near future.

Mr. Cosmo Johns (Sheffield) read a paper on the production and thermal treatment of steel in large masses. He indicated some of the conditions which differentiate works' practice from laboratory research.

An interesting feature of the meeting was an exhibition of pyrometers. At the Barrow meeting of the Iron and Steel Institute, the suggestion was made that, in view of the growing importance of pyrometers to the steel industry, arrangements should be made to enable members to see the actual working of different pyrometers in order to enable them to form their own opinions of the relative merits of the appliances available for metallurgical purposes. The council readily adopted this suggestion, and appointed a committee, consisting of Mr. R. A. Hadfield (vice-president), Mr. J. E. Stead (member of council), and Mr. B. H. Brough (secretary), to make the necessary arrangements for the exhibition. Invitations were sent to all the leading makers to exhibit pyrometers and to furnish brief descriptions of them. The descriptions occupied a pamphlet of sixty-two pages, and dealt with the following types :—(1) Baird and Tatlock pyrometer, (2) Bristol's recording air pyrometer, (3) Callendar and Griffith resistance pyrometer, (4) Le Chatelier pyrometer, (5) Mesuré and Nouel optical pyrometer, (6) Roberts-Austen recording pyrometer, (7) Rosenhain and Chalmers pyrometer, (8) Siemens electrical pyrometer, (9) Siemens water pyrometer, (10) Uehling pneumatic pyrometer with Steinbart automatic recorder, (11) Wanner optical pyrometer, (12) Wiborgh's thermophone, (13) Zaubitz pyrometer. In conclusion, a list of patents relating to pyrometry, compiled by Mr. H. G. Graves, and a full bibliography of the subject were given.

Mr. C. Lowthian Bell (Middlesbrough) read an important paper on the manufacture of coke in the Hüssener oven at the Clarence Iron Works, and its value in the blast furnace. The results show that with this oven a coke can be made giving as good results in the furnace as that made in the old beehive oven.

Dr. H. C. H. Carpenter and Mr. B. F. E. Keeling submitted a paper on the range of solidification and the critical ranges of iron-carbon alloys. The research, which was carried out at the National Physical Laboratory, confirms, broadly speaking, the accuracy of Bakhuis-Roozeboom's diagram. Further, the results indicate that the diagram will be amplified in certain parts when the equilibrium between the various phases has been more fully studied, viz. on account of (1) the small thermal change at about 790° for alloys with carbon content 0·8–4·5; (2) the slow thermal change at about 600° found over the whole range of alloys; (3) the evolutions of heat at about 900° found in alloys with carbon content of 3·87 and 4·50.

Mr. H. C. Boynton (Harvard University) submitted a paper on troostite, in which he gave the results of experiments made with the object of furnishing facts in regard to the identity of this constituent of steel, which, although mentioned by prominent metallurgists, has not apparently been generally accepted or understood.

A paper on the synthesis of Bessemer steel was presented by Mr. F. J. R. Carulla (Derby), in which he gave particulars of the manufacture of steel rails in 1874 by the acid process of a quality so uniform as to leave nothing to be desired. He urges that modern requirements should be equally well fulfilled, and that endeavours should be made to introduce improvements in the Bessemer process so as to prevent its being altogether put aside in favour of the open-hearth process.

Mr. W. J. Foster (Darlaston) submitted a paper on the thermal efficiency of the blast furnace, in which he gave the results obtained with the furnace at Darlaston 72½ feet high, in which the materials smelted are chiefly silicates of iron.

Mr. W. Rosenhain (Birmingham) contributed a paper on the plastic yielding of iron and steel. He described some new observations explaining the curved slip-bands in iron and mild steel. This curvature is shown to be probably due to a multitude of minute steps, and a reason is thus